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(54) Improvements relating to wheel mounted discs.

(57) The present specification discloses a wheel incorporating a braking disc (9). In certain wheels where high duty braking discs (9) are required, the discs (9) are mounted one on each side of the web (5) of the wheel by bolts which pass through spaced-apart holes in the discs (9). These holes, besides reducing the available braking area, also act as centres for surface cracking, this surface cracking occurring around the bolt holes as a result of the large internal stresses set up by differential thermal expansion.

The present invention provides a wheel wherein an annular braking disc (9) is mounted on each side of the central web (5) by means of resilient retaining connections (15) in the form of roll pins (17) which extend generally parallel to the axis of the hub (1), the roll pins (17) being secured to the web (5) in the region adjacent to the central hub (1) of the wheel, and engaging the inner edge region (27) of the braking disc(9). Whilst the roll pins (17) support and retain the inner edge (27) of the disc (9), they can, however, flex under thermal expansion of the disc (9). Preferably, the resilient retaining connections (15) are designed to be within the axial dimensions of the central hub (1) of the wheel to thus not effect the important spatial requirements of brake and wheel design. With this in mind the resilient retaining connections are secured to the web (5).

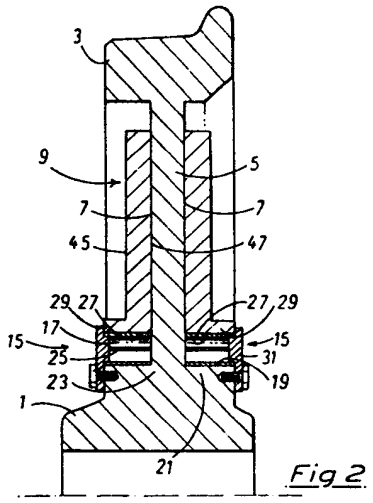

Fig 2

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Description

IMPROVEMENTS RELATING TO WHEEL MOUNTED DISCS

The present invention relates to a wheel incorporating a braking disc.

In particular the present invention relates to a wheel comprising a central hub and an outer rim, the hub and rim being interconnected by a web, with an annular braking disc secured to each side of the web. The braking disc may be a complete continuous annulus or composed of two or more curved segments. In certain wheels, especially railway vehicle wheels, high duty braking discs are required to cater for the braking of very large masses from high speeds. Certain such known braking discs are provided with a series of spaced apart holes through which bolts extend to secure the discs to the web of a wheel. However, as a result of the large amount of heat generated in the braking discs under braking, differential expansion causes large internal stresses to be set up around the bolt holes, and as a result surface cracking can and does occur. Clearly this is undesirable as it reduces the life of the braking disc.

The aim of the present invention is to provide a wheel wherein the braking discs are secured without the need for holes in the braking surfaces of the discs or discs segments, whilst accommodating thermal expansion without the occurrence of internal stresses at a detrimental level.

According to the present invention there is provided a wheel comprising a central hub and outer rim, the hub and rim being interconnected by a central web, an annular braking disc being mounted on each side of the central web by means of resilient retaining connections which are secured to the web on the region adjacent to said central hub, and resilient retaining connections each having the form of a roll pin located substantially parallel to the axis of the hub, the roll pins engaging the inner edge region of the annular braking disc.

In one embodiment of the present invention, the roll pins are located in partially cylindrical recesses formed at circumferentially spaced apart locations, on the widening part of the web, adjacent to the central hub of the wheel. Each recess extends axially of the wheel and each roll pin comprises a hollow cylindrical member made of spring steel, which has an axially extending slot of wavy profile, extending for the whole length of the cylindrical member. A roll pin is located in each partially cylindrical recess and the radially inner edge region of the annular braking disc is formed with complementarily spaced and dimensioned recesses which also engage with said roll pins. To hold the roll pins axially in position with respect to the wheel, an end cap is provided for each roll pin, each end cap being bolted to the web or hub and extending over and into the outer end of roll pin. The end caps preferably each have a tongue which engages in the slot of the roll pin to thus locate and hold the roll pins in the desired rotational position e.g. with the slots directed tangentially to the inner edge of the braking disc. Further, the inner edge of the braking disc is preferably extended axially of the wheel and the end caps engage this extension to hold the radially inner edge region of the braking disc against the planar surface of the central web of the wheel.

In contrast to forming said partially cylindrical recesses on said web, said recesses may be each or severally formed in a respective support member which can be bolted or otherwise fixed to the web or central hub of the wheel.

Said one embodiment of the present invention may be modified by providing a number of circumferentially spaced apart, axially extending bores in the radially inner part of the central web of the wheel. One, or two coaxially aligned roll pins as described hereabove, are then located in axial juxtaposition to each other in each bore, so as to project partially outwardly from each end thereof. End caps as described hereabove hold the roll pins in the bores and the inner edges of the respective brake discs or segments engage the projecting part of roll pins as described previously.

In another embodiment of the present invention generally L-shaped gripping members as viewed in axial cross-section with respect to the wheel, engage the outer edge of the braking disc segments at spaced apart locations, in addition to the resilient roll pins engaging inner edge regions of the braking disc segments as described hereabove. These L-shaped gripping members are bolted to the central web of the wheel so that one limb of the L-shape extends generally radially inwardly of the wheel and substantially parallel to but spaced from the planar web surface. This one limb of each gripping member extends into a radially extending, substantially complementary recess in the outer periphery of the annular braking disc. Whilst said one limb of each gripping member holds the outer edge of the braking disc firmly against the central web of the wheel, it does not extend radially into the recess to the maximum possible extent and neither does the outer edge of the braking disc engage the other limb of the L-shaped gripping member by means of which the gripping member is bolted to said web. Thus there are radial spaces available, to allow for radial expansion of the braking disc. If desired each annular braking disc can be formed by at least two curved segments.

In use, with any of the above embodiments of the present invention, radial expansion due to the heat generated under braking, is accommodated for by the resilient retaining connections flexing. Additionally the outer edge of the braking disc or segments can move radially, the outer edge in said another embodiment moving under said one limb towards or away from the other limb of each L-shaped gripping member. Further, expansion under heavy braking, resulting from the difference in temperature between the braking surface and the disc surface contiguous with the web of the wheel, will cause the radial extremities of the annular disc or segments to press against the central web of the wheel. This sets up stresses in the braking surface, which on cooling and after a number of such braking operations, can result in the braking surface tending towards being

concave. If the radially inner edge of the annular braking disc is held, then the radially outer edge of the disc will tend to move away from the web. In said one embodiment of the present invention the braking disc is designed such that said movement away from the web is minimal and within acceptable limits having regard to the required function of the braking disc. In contrast, said another embodiment of the present invention obviates this problem by holding the radially inner and outer edges of the annular braking disc against the central web whilst accommodating radial expansion, minimal stresses alone being thus set up on the disc due to the constraints provided.

The present invention will now be further described, by way of example, with reference to the accompanying drawings, in which:-

Fig. 1 is a front view of part of one embodiment of a wheel constructed according to the present invention;

Fig. 2 is a cross-sectional view taken along line X-X in Fig. 1;

Fig. 3 is a front view of part of another embodiment of a wheel constructed according to the present invention;

Fig. 4 is a cross-sectional view taken along line Y-Y in Fig. 3;

Fig.5 is a perspective view of a support member for use in providing a recess for a roll pin; and

Fig.6 is a cut-away view of part of a wheel showing the support member in position.

The wheel illustrated in Figs. 1 and 2 of the accompanying drawings comprises a central hub 1 and an outer rim 3 interconnected by a web 5 having planar surfaces 7. A braking disc 9 formed as an annulus is mounted on the planar surface 7 on each side of the web 5 using resilient retaining connections 15.

Each resilient retaining connection 15 comprises a roll pin 17 located in a part cylindrical recess 19 formed in a shoulder 21 on the widening part 23 of the web 5 adjacent to the hub 1. The part cylindrical recesses 19 are provided at circumferentially spaced apart locations on the wheel and extend axially of the wheel. Each roll pin 17 comprises a hollow cylinder of spring steel with an axially extending slot 25 provided along its full length; the slot 25 having a wavy profile. The radially inner edge of each annular brake disc is provided with curved recesses 27 which are of complimentary circumferential spacing and dimensions to the recesses 19, these curved recesses 27 engaging the radially outer portion of the respective roll pins 17. At least in the region of each curved recess 27, the inner edge of the annular brake disc has an axial extension 29, and an end cap 31 bolted to the shoulder 21 on the web 5, extends both over and into the axially outer end of the respective roll pin 17, and over the axial end of the axial extension 29. Thus the end caps 31 each hold a roll pin 17 in the desired axial position and also hold the radially inner edge region of the annular brake disc against the planr surface 7 of the web 5. Further, the end caps 31 each have a tongue which engages in the slot 25 of a roll pin 17 to hold the desired rotational position of the roll pin 17.

The wheel illustrated in Figs. 3 and 4 utilises the same resilient retaining connections 15 as used in the embodiment of Figs. 1 and 2, though additionally gripping members 33 engage over the radially outer edge of each disc 9.

The gripping members 33, as best seen in Fig.4, are each generally L-shaped in configuration and are bolted to the central web 5 with one limb 35 spaced from planar surface 7 and extending radially inwardly of the wheel, generally parallel to the planar surface 7. Whilst one bolt can be used for each gripping member 33 as shown in Fig.4, a single bolt can alternatively extend through the web 5 and secure two aligned gripping members on opposite sides of the web 5, to the web 5. The gripping members 33 on each side of the wheel, are arranged at equi-spaced apart circumferential locations adjacent to the wheel rim 3, with said one limb 35 extending into a substantially complementary recess 37 formed on the front face of the brake disc 9. Said one limb 35 holds the radially outer edge region of the brake disc 9 firmly against the planar surface 7 of the web 5. However, there is clearance both between the free end of said one limb 35 and the radially inner base 39 of the recess 37, and between the radially outer edge of the disc 9 and the other limb 41 of the gripping member 33. Thus, whilst being held firmly against the web 5, the disc 9 may expand radially inwardly or outwardly. If desired each annular disc can alternatively be formed in at least two segments.

Whilst in the above-described embodiments of the present invention the part-cylindrical recesses are formed in a shoulder 21 on the widening part of the central web 5 adjacent to the hub 1, each part-cylindrical recess 19 can alternatively be formed in a respective support member 43 (Fig.5) which can be bolted as at 44 to the wheel adjacent to the hub 1. In this way, existing wheels can be modified in accordance with the present invention.

In a modified form of the embodiment of Figs. 1 to 4, a number of bores (not shown) are provided in the widening part of the web 5 adjacent to the hub 1, at circumferentially spaced apart locations around the hub 1. Each bore extends through the web and either one or two coaxially aligned roll pins are located in the bore so as to project out from each end of the bore and provide support for the radially inner edge of the annular brake disc. End caps (not shown) as described hereabove are similarly used.

Essentially in any of the above-described embodiments, the roll pins and end caps do not project beyond the axial extent of the hub 1. Thus the important spatial requirements of wheel design are not affected by this brake disc brake mounting.

In particular in the modified embodiment of Figs. 1 to 4, the arrangement of roll pins, end caps and fixings may be compressed axially so that they do not project beyond the axial extent of the braking surfaces of the disc, thus achieving further advantages in spatial characteristics.

In use with any of the above described embodiments of the present invention, radial expansion due to the heat generated under braking, is allowed for by the resilient retaining connections 15, 31 flexing

and in the embodiment of Figs. 3 and 4, by the outer edge of the braking disc or segments, moving under said one limb 35 towards or away from the other limb 41 of each L-shaped gripping member 33. Further under heavy braking, expansion due to the differences in temperature between the braking surface 45 and the disc surface 47 contiguous with the web 5 of the wheel, will cause the braking surface 45 to expand and for the radial extremities of the annular disc 9 to press against the central web 5 of the wheel.

The present invention thus provides a simple way of mounting a brake disc on a wheel, expansion being catered for so that minimal internal stresses are set up on the braking disc due to such expansion.

Claims

1. A wheel comprising a central hub (1) and outer rim (3), the hub (1) and rim (3) being interconnected by a central web (5), an annular braking disc (9) being mounted on each side of the central web (5), characterised in that each annular braking disc (9) is supported by means of resilient retaining connections (15) which are secured to the web (5) in the region adjacent to said central hub (1), said resilient retaining connections (15) each taking the form of a roll pin (17) located substantially parallel to the axis of the hub (1), the roll pins (17) each engaging an inner edge region (27) of the annular braking disc (9).

2. A wheel as claimed in claim 1, wherein the roll pins are each located in a part-cylindrical recess (19) formed on part (23) of the web (5) adjacent to the central hub (1), said recesses (19) being formed at circumferentially spaced apart locations around the hub (1) and extending generally parallel to the axis of the hub (1).

3. A wheel as claimed in claim 1, wherein the roll pins (17) are each located in a part-cylindrical recess (19) formed in a support member (43) which is secured to the web (5) adjacent to the central hub (1), said support members (43) being located at circumferentially spaced apart locations around the hub (1) with said recesses (19) extending generally parallel to the axis of the hub (1).

4. A wheel as claimed in claim 1, wherein said roll pins (17) are located in bores which are formed in the web adjacent to the hub (1), said bores extending axially through the wheel at circumferentially spaced apart locations around the hub (1), to form part-cylindrical recesses (19) at each axial end region of each bore.

5. A wheel as claimed in any one of claims 1 to 4, wherein each roll pin comprises a hollow cylindrical member made of spring steel, which has an axially extending slot (25), extending for the whole length of the cylindrical member.

6. A wheel as claimed in any one of claims 2, 3 and 4, wherein end caps (31) bolted to the web (5) or hub (1) extend over the outer end of each roll pin (17) to hold the respective roll pins (17) in said part-cylindrical recesses (19).

7. A wheel as claimed in claim 6, wherein each said end cap (31) extends into an end of a roll pin (17) to hold the roll pin (17) in said recess (19) and secure the roll pin (17) in a desired rotational position with respect to said recess (19).

8. A wheel as claimed in any one of the preceding claims, wherein the radially inner edge of the annular braking disc (9) has recesses (27) so located to engage said roll pins (17).

9. A wheel as claimed in claim 8 when dependent upon claim 6, wherein the inner edge region of the annular braking disc (9) is extended axially of the disc (9) in the region of said recesses (27) in the disc (9), said end caps (31) engaging these extended regions (29) of the disc (9).

10. A wheel as claimed in any one of the preceeding claims, in which the roll pins (17) are dimensioned and arranged to lie within the axial extent of the hub (1).

11. A wheel as claimed in any one of the preceding claims, wherein gripping members (33) secured to the said central web (5) engage the outer edge region of said annular braking disc (9), at circumferentially spaced apart locations.

12. A wheel as claimed in claim 11, wherein said gripping members (33) each have a limb (35) extending generally radially inwardly of the wheel and substantially parallel to but spaced from the central web (5), said limb (35) extending into a radially extending, substantially complementary recess (37) in the outer periphery of the annular braking disc (9).

13. A wheel as claimed in claim 12, wherein said limb (35) holds the braking disc (9) firmly against said central web (5) but does not extend radially into the said substantially complementary recess (37) to the maximum extent, clearance also existing between the outer edge of the braking disc (9) and said gripping member (33).

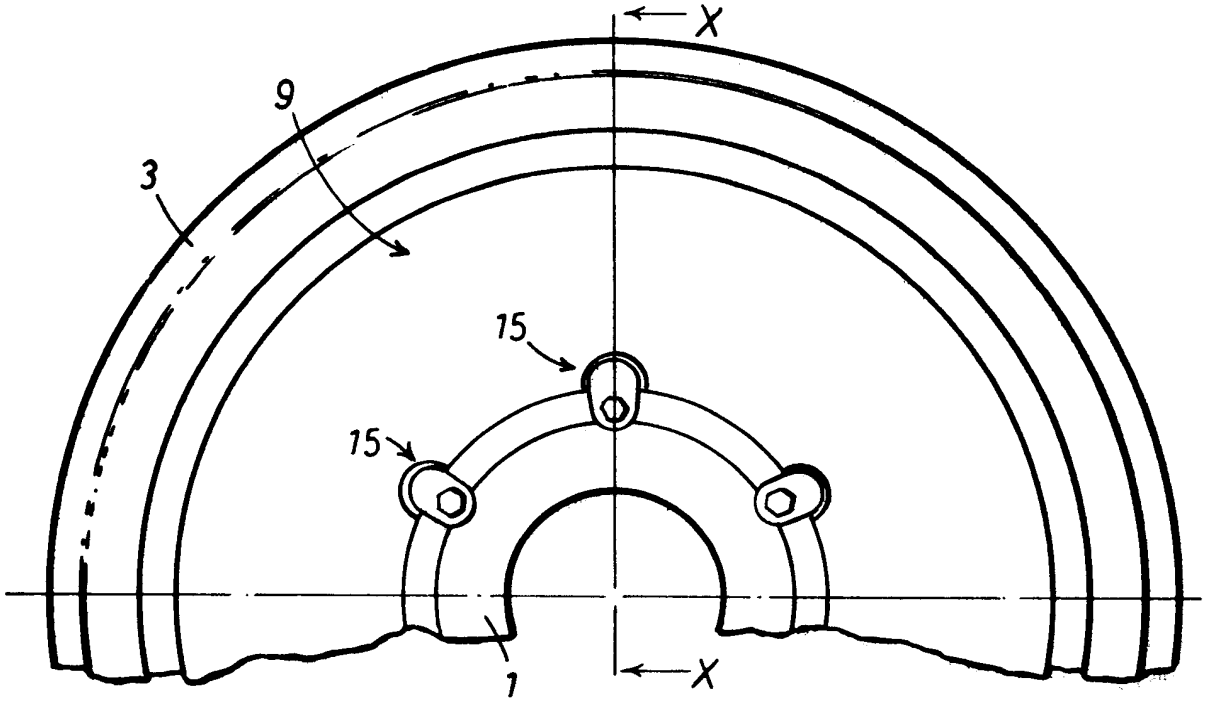

Fig 1

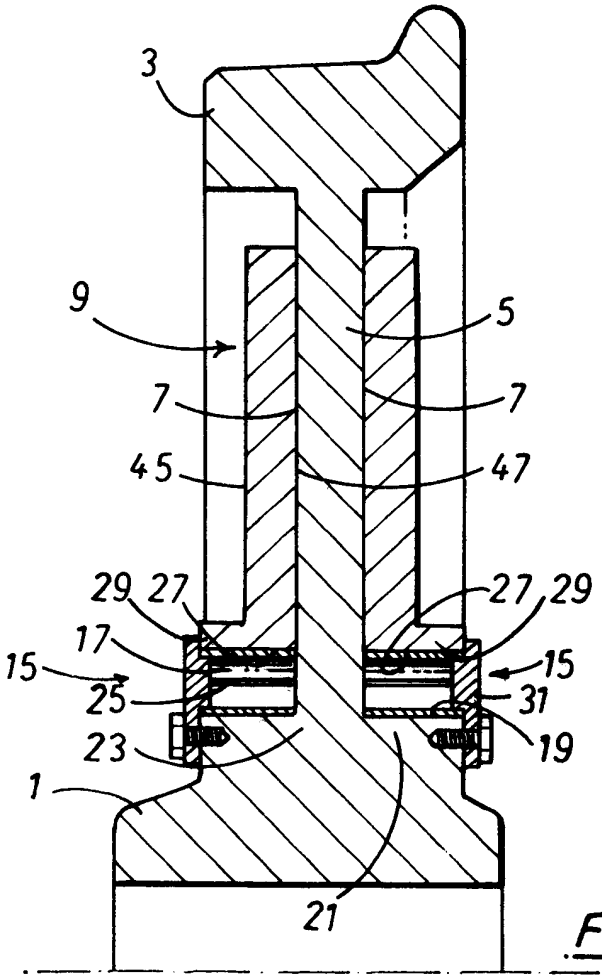

Fig 2

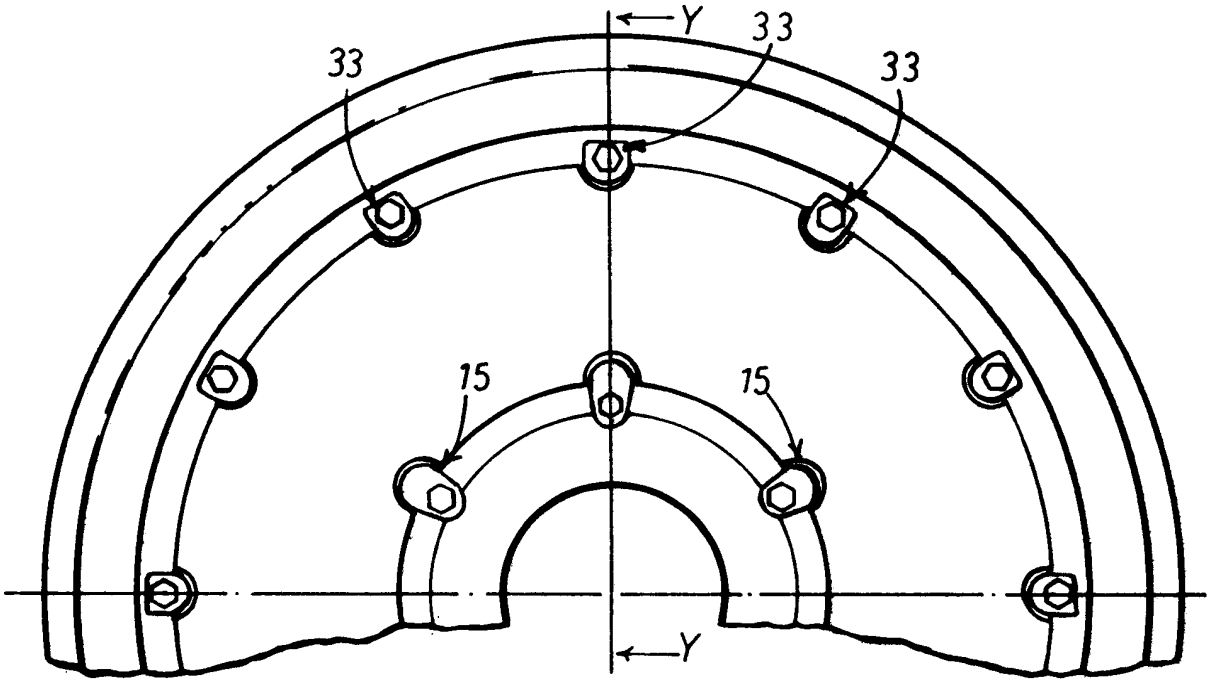

Fig 3

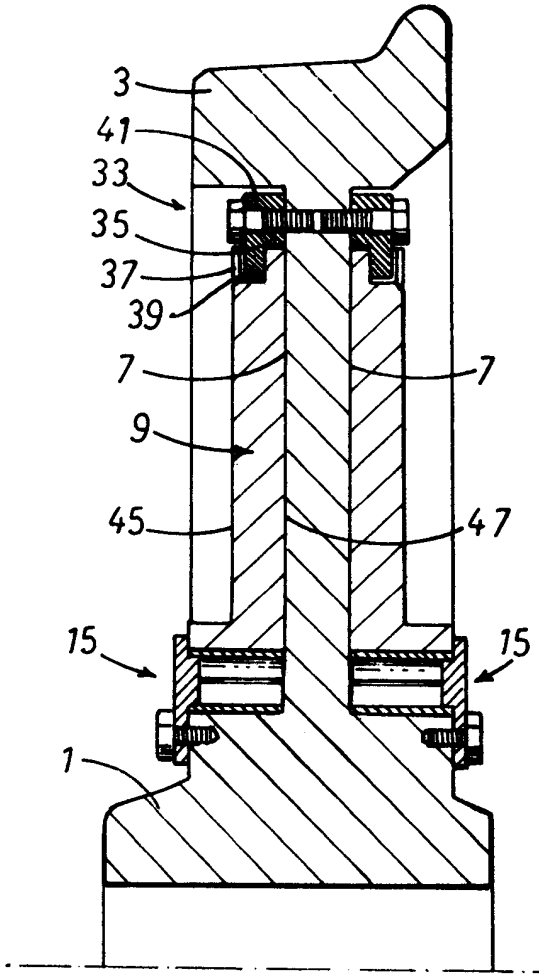

Fig 4

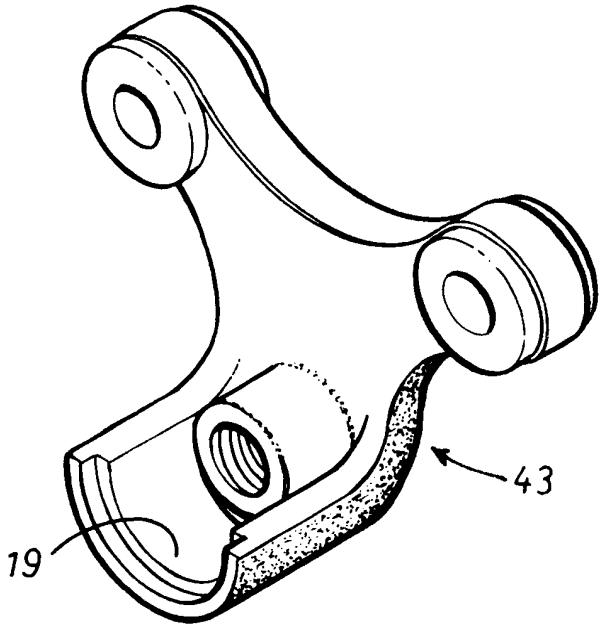

Fig 5.

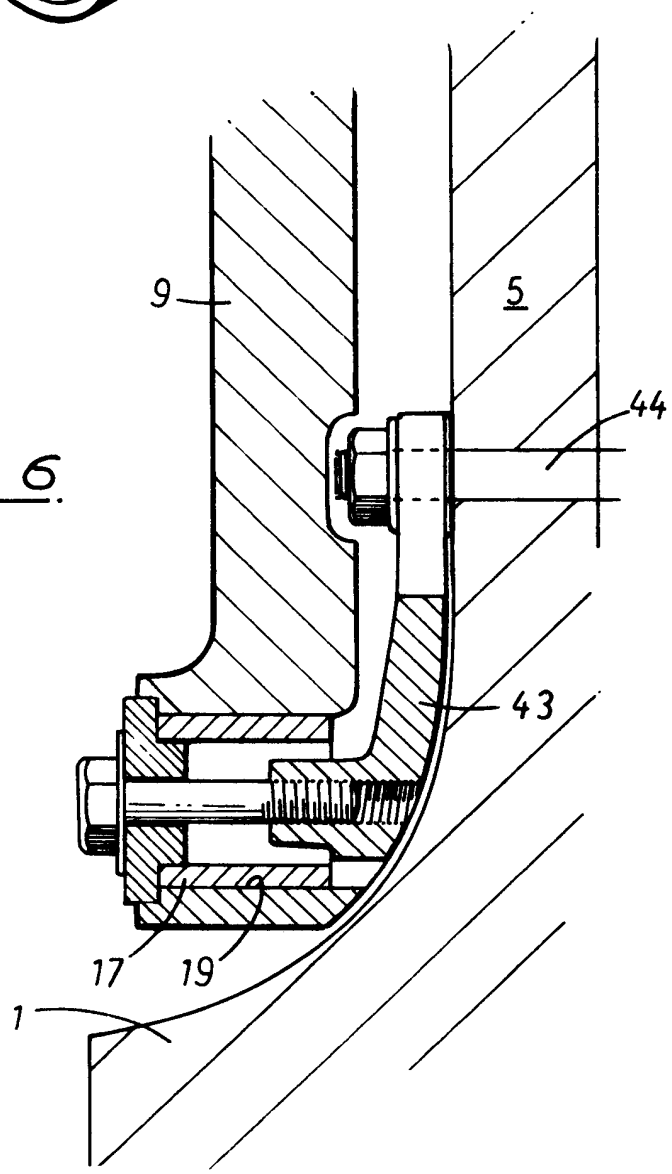

Fig 6.

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EUROPEAN SEARCH REPORT

Application number

EP 86 30 6683

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int Cl 4)
A	DE-B-1 175 721 (BOCHUMER VEREIN FÜR GUSSSTAHLFABRIKATION A.G.) * Whole document; figures 1-12 * ---		F 16 D 65/12
A	DE-B-1 158 095 (BOCHUMER VEREIN FÜR GUSSSTAHLFABRIKATION A.G.) * Whole document; figures 1-6 * ---		
A	GB-A-1 528 126 (GIRLING LTD.) * Whole document; figures 1-8 * ---		
A	GB-A-1 478 696 (PONT-A-MOUSSON S.A.) * Whole document; figures 1-4 * ---		
A	CH-A- 469 589 (KNORR-BREMSE GmbH) ---		TECHNICAL FIELDS SEARCHED (Int Cl 4)
A	US-A-4 058 190 (GARDNER) ---		F 16 D 65/00 F 16 D 3/00
A	GB-A-2 136 921 (LUCAS INDUSTRIES PUBLIC LIMITED CO.) ---		
A	EP-A-0 065 312 (KNORR-BREMSE GmbH) ---		
A	DE-A-2 806 028 (KNORR-BREMSE GmbH) --- -/-		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	08-12-1986	BRAEMS C.G.I.

CATEGORY OF CITED DOCUMENTS

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EUROPEAN SEARCH REPORT

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DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int Cl 4)
A	GB-A-2 037 940 (ETABLISSEMENTS GEORGES LUCAS) ---		
A	DE-A-1 680 379 (BERGISCHE STAHL-INDUSTRIE) ---		

			TECHNICAL FIELDS SEARCHED (Int Cl 4)

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